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SANITATION IN RURAL COMMUNITIES

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Sanitation is man's best defense against his surroundings. Disease and death have become recognized as due not only to inherited weaknesses of the individual, but in a large measure to the influence of the external world upon him. This outer world is the medium which contributes the bacteria of infectious disease. One after another the diseases in the list of causes of death have been discovered to be due to bacteria which invade the human body and destroy it by the growth of their colonies and the formation of poisonous products.

Public interest has followed the lead of the scientific investigators. Under the name of sanitary science the fight against these poisonous plants, so-called bacteria, is being carried on. By sanitation the numerous avenues by which the bacteria are accustomed to travel to produce their outbreaks of disease are being closed up, their resting places are being destroyed, and the original sources of infection are being discovered.

The principles involved in the sanitation of rural communities differ in no respect from those of sanitary science in general. The gathering together of men into large cities or small towns or isolated dwellings modifies only the method of applying these principles.

Rural Population

In the year 1790 the population of the United States was about four million persons of which 96.7 per cent lived in a rural state and 3.3 per cent lived in cities. In the year 1900, with a population of about eighty million, there was 66.9 per cent living in rural districts and 33.1 per cent in cities. These figures may be one reason for the often repeated statement that the farm is being deserted and the people flocking to the cities. There is certainly no doubt that some of the farming districts in the eastern part of the country, particularly in New England, are suffering from depopulation;

but on the other hand it is equally certain that in the middle and western part of the country the rural districts are becoming more thickly settled. The rural situation appears more plainly if the figures are tabulated as follows:

Year.	Population.	Urban.	Rural.
1790	4,000,000	132,000	3,868,000
1900	80,000,000	26,480,000	53,520,000

Thus, while the number of persons living in cities is relatively larger than during the century past, the rural communities have received an actual addition of over fifty million inhabitants while the cities have increased by twenty-six millions, or by one half the number.

Absence of Official Supervision of Rural Sanitation

The mere fact that country life is more natural to man and that he is by nature an outdoor animal, tends in some respects to make him revert toward the savage mode of existence, while sojourning in the country. The more ignorant and untrained he is, the more is this likely to be true. In the city he is a part of a civilized community and subject to its laws and customs. In the country, on the other hand, he is chiefly a law unto himself.

Among the institutions established for better administration of city life is the city department of health, whose function is the enforcement of rules and regulations controlling the character of buildings in which the people live, the protection of their foods and drinks against transmissible diseases, the proper removal of all household wastes, and the care of the sick, and especially of those suffering from transmissible disease. In large cities this control is comparatively rigid and efficient. In smaller towns it is much less so, while in rural communities it is still less. Thus, in a large city public authorities define the number of windows and the amount of ventilation required for dwellings. The water supply, the sewerage system, the garbage and ash removal are all in charge of public officers. Milk, meat, vegetables, fruits and all other foods are inspected and under the control of the health authorities. Hospitals and sanitariums are established for the sick and for the quarantining of contagious diseases. In rural districts, on the other hand, each man's home is as he may desire to make it. His water

and sewerage system, his method of disposal of waste, his milk and food supplies are all under his own personal control. Public authorities do not interfere with him in his management of such matters. The quarantining of infectious diseases is usually the only function performed by his town or county health officers, to protect him from preventable diseases.

Death Rates—Rural vs. Urban

In the year 1908, seventeen states in the Union gathered records of the deaths occurring within their boundaries. These included all of the New England states, the Middle Atlantic states with the exception of Delaware, four states in the middle West, and three in the extreme West. None of the Southern states furnished any reliable statistics and the greater part of the middle and western states are also lacking in this respect. Consequently the statistics received concerned chiefly the northeastern part of the country, and for this reason the reports must be accepted with some reservation. When the great Negro population in the South and the large agricultural districts of the middle and western part of the country are included, the figures will without doubt be considerably modified. A partial list of the deaths occurring in the registration area, in cities and in rural communities is as follows:

Disease.	Deaths per 100,000.	
	Cities.	Rural.
All causes	1,654.6	1,396.0
Typhoid	24.5	24.3
Malaria	1.1	1.7
Smallpox	0.1	0.2
Measles	13.5	8.2
Scarlet fever	17.4	8.0
Whooping cough	10.4	11.9
Diphtheria and croup	27.9	17.3
Influenza	16.8	27.9
All other epidemic diseases.....	10.6	13.3
Tuberculosis of the lungs.....	169.1	117.3
All other forms of tuberculosis..	29.2	19.3
Cancer	80.5	68.0
Tumor	1.1	0.9
Diabetes	15.1	13.6
Meningitis	21.4	17.1
Other nervous diseases.....	131.6	153.2
Diseases circulatory system	190.4	175.1

Disease.	Deaths per 100,000.	
	Cities.	Rural.
Pneumonia	107.8	82.9
Other respiratory diseases.....	103.3	61.9
Diarrhea and enteritis.....	133.5	96.9
Other diseases digestive system.	85.8	74.3
Bright's disease and nephritis...	113.9	73.7
Infancy	84.3	58.9
Suicide	20.4	14.4
Accident	96.8	101.0
Ill defined	26.9	26.7
All other causes.....	120.1	122.7
Unknown	1.0	5.3

In the first place it appears that the total number of deaths from all causes is less in rural districts than in cities. If the percentage given in the table be applied to the estimated population at the present time, assuming that the percentage of persons living in cities is approximately the same as it was in the year 1900, we would obtain the following results.

Total population, 1910, 92,000,000; of which about 67 per cent live in rural communities, or 61,640,000; while the city population, representing about 33 per cent amounts to 30,360,000. Applying the death rate in the above table for cities to the city population, we would have a total of 502,336 deaths occurring in the cities. Taking an equal population in rural districts and applying the rural death rate, we obtain 423,825 deaths in an equivalent rural population. This gives a difference of 78,511 more deaths occurring in the cities in the year than in an equivalent population living in rural districts. It may not be unfair, therefore, to attribute this excess of deaths to the unfavorable conditions of city life. It seems to me that we must include in our list of causes of death "city life," and place it in the list with tuberculosis, pneumonia, and other causes.

Some of the comparative death rates from specific diseases in the table are of great interest. It is noteworthy that the typhoid death rate is about the same both in cities and in rural communities; on the other hand there is more malaria in the country than in the city. The deaths from measles, scarlet fever, diphtheria, however, are much more numerous in cities than in the country. All forms of tuberculosis and pneumonia are also greater in cities. Diarrheal diseases, which include infant diarrheas, are

also greater in cities; Bright's disease is considerably greater, and diseases of the circulatory system; while deaths from accident on the other hand are greater in the country districts.

Tuberculosis, pneumonia, bronchitis to which overcrowding and impure air contribute, and measles, scarlet fever, and diphtheria are transmitted from person to person to which overcrowding gives opportunities and are naturally greater in cities. The impure milk and summer heat of cities account for the excess of infant diarrheas. Lack of exercise, the sedentary life of business men, and improper food would account to a certain extent for the excess of deaths from Bright's disease in cities. The presence of mosquitoes in country districts is a reason for the higher death rate from malaria. Impure water supplies and milk supplies is the chief reason for the typhoid death rate being at least as great in the country districts as in the cities. There are, of course, numerous differences in the table which cannot be readily explained. Cancer is not sufficiently understood. The greater death rate from nervous diseases in the country districts is also not so easy to understand.

It is obvious on the whole that there are a number of diseases in the list which cause deaths in rural communities which can be largely prevented by proper sanitary measures. These diseases are the following: Typhoid, malaria, smallpox, measles, scarlet fever, whooping cough, diphtheria, influenza, tuberculosis, meningitis, pneumonia and diarrheas.

Morbidity—Rural vs. Urban

It is not possible to secure accurate statistics of the kind and of the extent of illness existing in rural districts as compared with other sections. One can see how in general the number of diseased persons at any one time in rural districts is likely to be less than the number in cities, because the death rate is less. Yet this only applies to those diseases which are common to both city and country, and which are common causes of death. There are diseases on the other hand which are not common to the country and city, and which may not be included in the usual list of mortality statistics.

Prominent among the diseases peculiar to country districts must be mentioned infection with intestinal parasites. In Porto Rico from 90 per cent to 100 per cent of the population in the year 1900

were infected with hookworm. Over 31 per cent were infected with a parasite known as the eelworm, while infections with other parasites existed to a less degree. In the middle and northern United States 7.69 per cent of the population are infected with the whipworm and with other parasites to a lesser degree. In the Southern states the number of persons infected with hookworm exceed the infections with all other parasites combined.

In the Philippines 80 per cent of the population are infected with intestinal parasites of one or more kinds. All of these infections are peculiar to country districts and are not found so commonly in cities. They fall into the catalogue of preventable infections and for that reason come within the scope of the diseases to be considered by sanitary science.

Household Sanitation

In the application of sanitary measures to rural communities, as in fact to any community, perhaps the first item to be considered is the cleanliness of the dwelling. More attention has been given to this branch of sanitation in the past than to any other. In fact it has not been the sanitary expert or the professor of sanitary science who has emphasized the importance of cleanliness in the household, so much as the housekeepers themselves. Dutch housewives for centuries have been proverbial. In certain parts of New England extreme attention is given by housewives to certain features of cleanliness. One may visit almost any rural community in the New England states and be impressed with the degree of anxiety shown by the housewives for the removal of dust and the sweeping of rooms. The semi-annual "house-cleaning" is almost a religious ceremony. It is, perhaps, unfair to remark that the degree of attention given to this branch of sanitation is out of all proportion to its importance, and that the very home in which it is exercised to the highest degree may be drinking polluted water and may possess unsanitary methods for the disposal of sewage, drainage and household waste, and is very likely to have a large manure pile within easy distance of the kitchen door. It is a fact that these external conditions have only come to be recognized as important factors to the health of the household in comparatively recent years.

Dish Washing

The necessity for internal cleanliness of the building, its floors and walls, of rooms and of the removal of dust and dirt is so deeply impressed upon the housekeeper in rural communities that it needs no further emphasis. There is one feature of household sanitation, however, which does deserve special attention. This is the washing of dishes and other utensils used in the kitchen and dining room. The transmission of the bacteria inhabiting the nose and mouth and throat and lungs, and such bacteria as may be clinging to the hands and fingers is particularly easy by means of the kitchen and table ware. The handling which such implements receive during the family meal is one which readily conveys any personal infections to their surfaces. Influenza, tuberculosis, pneumonia, bronchitis, sore-throat, tonsilitis, diphtheria, scarlet fever, measles, typhoid fever, dysentery, and other infections which cause discharges from any portion of the body, particularly from the mouth and nose, can become attached to table ware in a way which prevents them from being removed unless they are thoroughly washed and sterilized. It is a common thing for knives and forks used by a person infected with tuberculosis at one meal to be used by some other person at the next meal, and in this way serious chances of infection may occur. Consequently the washing of these implements is a most important matter.

A survey of the methods in common use in the average household shows that this operation is often a hasty one or is left in the hands of some ignorant servant or even when done under the supervision of the mistress herself is not done in a scientific manner. Soaps which do not dissolve grease or remove clinging matter are used instead of solutions of soda. The use of one pan of water unchanged, or infrequently changed is common rather than several pans of water frequently changed so that all utensils shall receive a thoroughly clean rinsing. Dish rags are used instead of brushes, and the final scalding with boiling hot water is frequently omitted. By the use of brushes, solutions of soda, a thoroughly clean rinsing, and finally scalding water, dishes and table ware can be washed and sterilized so that they stand no chance of conveying infection from person to person.

Air

One of the highest places in the list of causes of death in rural communities is occupied by tuberculosis. The only disease approaching it as a cause of death is heart disease and other diseases of the circulatory system. At first thought, the open air life of persons residing in rural districts is hard to reconcile with the great extent of tuberculosis in such communities. It is, of course, necessary to remember that tuberculosis is caused by bacteria and that it is commonly a chronic disease which means that the person infected therewith carries the bacteria in his system for a considerable length of time and is usually a source of infection to those among whom he dwells. Houses have been credited with being haunted by tuberculosis. Records show that persons dwelling in certain houses come down with the disease while those dwelling in other houses do not. In large cities, departments of health show by their maps certain blocks, and particularly tenement houses, in which large numbers of cases of tuberculosis have occurred year after year. In rural communities the same thing is true, and certain houses are pointed to as being the home of this disease; but while it is true to an extent that the floors and walls of dwellings may for a limited period retain tubercular infection, we now know that the transmission of the disease is usually more direct and that it is the fresh discharges from tuberculous persons that are most to be dreaded, and are the principal causes for the prevalence of this disease. It is the carriers of tuberculosis living in rural communities who transmit the disease to the members of their families and to those with whom they come in contact.

But in the pure air of the country one would naturally expect to find a very much smaller death rate from tuberculosis than in the cities. Summarizing the figures in the previous table it appears that in cities the death rate from tuberculosis is 198.3, while in rural districts it is 136.6 per hundred thousand population.

One of the chief reasons for this high mortality in rural districts is the practice of sleeping with closed windows. This is almost universal on farms and in villages. While the farmer may breathe pure air all day long yet when he retires at night he conceives it to be necessary for his comfort to have his bedroom window tightly closed. Whether the reason for this be that in the winter

time he fears the cold and in the summer time he fears invasion of insects, yet it is a common experience to find the air of country bedrooms foul and close. For this reason at that period in the twenty-four hours when the process of repair is uppermost, the dweller in rural districts probably breathes air as foul, if not more so, than the dweller in the large city.

The ventilation of the country house is rendered comparatively easy because open fire places are so common. The proper management of the windows of the dwelling is all that is necessary to insure an abundant supply of fresh air to the inhabitants at all times. The use of stoves, open fire places and kerosene lamps which rapidly consume oxygen makes window ventilation even more necessary.

In the country house proper attention must be given to the condition of cellars to prevent dampness and damp air on the first floor and to the removal of all decaying vegetables and refuse and to the prevention of odors from manure and from the stable.

Light

The necessity of sufficient light to the country dwelling is so elementary that it seems hardly necessary to mention, yet it is worthy of remark because of the common practise in rural communities of keeping certain portions of the dwelling in constant darkness. Parlors which are only used for weddings and funerals are common, and shutters and curtains are used to darken rooms to prevent carpets and upholstery from fading. But the absence of light results in dampness and deprives these rooms of the benefits of nature's own best disinfectant. I think, however, that the disinfecting power of light as applied to dwellings has been somewhat over-emphasized. At the same time it must be remembered that human beings were not made to live in darkness and that light has an important stimulating action on the human organism. The late lamented Commissioner Waring was accustomed to say that "Faded carpets were of much less importance than faded cheeks."

Water Supply

If one were to attempt to determine just what class of diseases was increased by existence in rural districts, one would naturally examine the results upon those who have been accustomed

to dwell in cities when a change is made to a rural existence. In this connection we may refer to the history of disease in armies on the march and in time of war, when large bodies of men leave their settled camps and enter into a strictly rural type of life. In the Mexican war the chief cause of death was diarrhea; in the Crimea, typhus, malaria and typhoid were the causes of death; in the Civil war dysentery and malaria were at the head of the list; in the late Spanish war the order was malaria, dysentery and typhoid; in the Boer war the chief diseases were typhoid and dysentery; in the Japanese army beri-beri, dysentery and typhoid were the prevailing diseases. Inflammation of the intestines were in most of these instances the cause of death.

The water supply is without question the readiest means for the transmission of infections which cause intestinal disease. This is because the bacteria of intestinal infections so often contaminate water supplies through contact with sewage or the drainage from outhouses. The dug well is the most common form of water supply used by rural dwellers. It is usually the easiest method for obtaining water and can be located at a point convenient to the kitchen door. It is also a common practice to have out-door privies located at a convenient distance to the house, and in many instances their location is one which makes contamination of the well easy. Well water is also frequently contaminated by barn-yard drainage and stable drainage. Surface washings from the door-yard and from the laundry and from the kitchen sink may also find their way into the well. A large number of examinations have been made of wells on farms both in the east and in the western part of the United States, and a summary of the results shows that at least 60 per cent of the wells examined were seriously contaminated with the bacteria which are identified with sewage.

Cisterns and springs in like manner may be contaminated. Outbreaks of typhoid fever from these contaminations are so numerous that the literature is filled with their reports. I may quote one instance which came under my personal observation, namely, that of an Episcopal parsonage on Long Island, where a number of cases of typhoid appeared in the family without apparent cause. Drinking water was obtained from a cement cistern which was supplied by rain water collected on the slate roof. This water supply seemed to be most carefully protected from contaminations.

The house was equipped with modern plumbing, and the drainage ran through sewer pipes to a cesspool which was located several hundred feet away from the cistern. When a lantern was lowered into the cistern black streaks were noted oozing through a crack in the cement wall. When an excavation was made in the earth at the side of the cistern a break was discovered in the sewer pipe leading from the house, and the ground between the pipe and the cistern was saturated with sewage. There is no doubt that some visitor to the family caused the first typhoid case by polluting the drinking water, and that the disease was continued by further pollutions of succeeding cases.

A pure water supply is positively necessary for health. A reasonable per diem allowance is from fifty to seventy-five gallons per capita. The running water of brooks is a safe source of supply, provided there are no dwellings which drain into it. Rivers and lakes, while often a source of supply for cities, can be of use only to the rural districts located on their shores. Wells and cisterns must continue to be the main reliance of country dwellings. Among these the driven and artesian wells are the best type. A reason for this is that when properly constructed they do not receive surface washings or surface water, but are sealed at the top and draw their supply from a considerable depth beneath the surface. Deep ground water usually comes from a considerable distance, and has passed through such an extent of soil and rock that it has been thoroughly purified.

Dug wells, which draw their water only from the surface layers of the soil, may furnish safe supplies only when located at a considerable distance from possible sources of pollution, and when properly protected against surface washings. One good method of protection is to dig a circular trench three or four feet deep at a distance of about six feet from the edge of the well which can be filled with rough stone so that all surface washings will fall into this trench rather than into the well; by a suitable underdrain leading off from this ditch all surface water can be led away from the well. Another safeguard is to close entirely the top of the well, using no ropes or buckets, but having a pump attached which discharges the water considerably to one side of the well opening, thereby preventing any of the discharged water from falling back into the well.

There are now a number of types of efficient filters at reasonable prices, which can be supplied for country residences and can be attached to wells or cisterns or other sources of supply, and when properly operated will remove any chance pollutions that may occur in the waters. In emergencies sterilization of the water can be performed by boiling and by the use of chemicals, among which chloride of lime is best.

Foods

Fresh food of all kinds is associated in one's mind with country life. Consequently at first thought one would assume that sanitary science had little comment to make on this subject. In the matter of vegetables and fruits there is in fact but little to be said, not only for the reason that such fruits are usually produced on the premises, but because their preservation has been such a matter of study and practice in rural communities that most country housewives are proficient in the canning and drying of fruits and in the proper care of winter vegetables.

In the matter of meat and fish, however, there are some improvements that can be made. The lack of ice and facilities for refrigeration is very common. The cellar is often the only means for keeping food cool. The temperature of a cellar is not sufficiently cool to furnish any real preservative action on meats or on fish. The decay of meat and fish is caused by the bacteria of putrefaction which produce poisonous substances known as "ptomaines." Ptomaine poisoning is the name given to the severe symptoms which follow the eating of decayed meat and other foods.

It is therefore to be recommended that in those parts of the country at least where ice forms in the winter, rural communities make a practice of gathering ice and using it for refrigeration during the warm months of the year.

Meat and pork used in country districts are for the most part killed by local butchers and are a local product. The meat of these animals is not subject to scientific inspection and for this reason may at times be diseased. Tuberculosis has become very common among beef cattle in this country. In Europe it is estimated that forty per cent of the cattle are diseased with bovine tuberculosis; and in the United States a summary of the various estimates range from thirty-three to three per cent, with the disease probably on

the increase. From the examinations which have been made of human beings afflicted with tuberculosis it appears that the bovine type is practically limited to children. For this reason it seems likely that it is not often transmitted through diseased beef. The cooking of meat may be one reason for this. At the same time it would be in the interest of the inhabitants of rural communities if a better system of meat inspection could be established.

A more serious threat against the health of rural communities is found in the parasites which inhabit both beef and pork. The term "measly" beef and "measly" pork is used to describe the flesh of animals marked by the larvæ of tape-worms. Unless such meat is thoroughly cooked it causes tape-worms to develop in the intestines of those who consume it. Swine are particularly likely to be infected with this disease, and the thorough cooking of pork and of ham must be carried out to prevent the infection from being transmitted.

Trichina is the name of a species of worm which infects at least two per cent of the hogs in the United States. These also infect man and cause much physical discomfort. They are easily killed in pork by proper cooking.

Milk

A leading physician in one of our large cities stated to the writer that it was a great pleasure for him to take a trip to the country so that he could secure a drink of milk which had in it the real "cowey" flavor. He expressed surprise that the flavor which he so desired was entirely absent from the glass of milk he was drinking on the premises of a certified dairy. It was necessary to explain to him that this "cowey" taste was not natural to milk, but was due to its pollution with cow manure. His remark, however, illustrates how common the pollution of milk with cow manure is because he is no exception in believing that the so-called "cowey" flavor is natural to milk.

Milk in the country is fresh, but it is not necessarily clean or free from infectious diseases. Those who dwell in country districts have the great advantage of securing milk before it has become many hours old; but in many instances the milk is obtained from cattle which are diseased, and is handled in a manner which exposes it to contaminations with dirt and with bacteria.

A prominent veterinarian who has examined over twelve thousand cows in New York State by means of the tuberculin test, asserts that in his opinion sixty per cent of the dairy cattle furnishing milk to New York City are infected with tuberculosis in some degree. Examinations made of milk sold on the streets of New York City and of the cities of Washington and Chicago, and of Leipsic, Germany, show that the bacteria of tuberculosis are present in more than ten per cent of the samples examined. Consequently we must believe that a considerable part of the milk which is used in rural communities is infected with tuberculosis. This is a matter more serious for the children and babies than for the adults.

Manure and dirt from the stable or from the cows' udders and coats, from the hands of the milkers and from the milking pails and pans are all offensive to the sense of decency, if not a menace to health.

Bacteria of typhoid fever, scarlet fever and diphtheria are often transmitted through milk. These bacteria get into milk from persons engaged in milk handling or from the water in which milk utensils are washed.

It is possible for the average farmer to produce a clean and safe milk for his own use and for the use of his neighbors by very simple and inexpensive means. His cattle can be kept in perfect health with the assistance of a competent veterinarian, and it is to the financial interest of the farmer in the long run to see that this is done.

By the use of tar paper and whitewash and home-made cement he can have a sanitary cow stable at small cost.

A covered milking pail or milking can in place of the old-fashioned wide-mouthed pail will keep nine-tenths of the dirt and bacteria out of the milk during milking time. By the use of a brush and a solution of soda followed by a rinsing in perfectly clean water and a final scalding with boiling water all milk utensils can be kept clean and sterile.

Milk for family use may be had twice daily and should be used on the farm as fresh as possible. For all milk that is to be carried to a village or town, preservation with ice is positively necessary. Where ice cannot be had upon the farm, several farmers in the district can combine their interests, and by co-operation se-

cure a supply of ice at some central place to which their milk can be carried for refrigeration. This plan makes the cost to each farmer a very reasonable one.

Sewage Disposal

Perhaps the most difficult problem to be faced in rural communities is the proper handling of sewage. This includes not only the bowel discharges of the inhabitants, but the drainage from laundries, kitchens, barnyards, etc. Large cities are usually located upon rivers and lakes, into which the sewage can be discharged and disposed of by dilution with great quantities of water. Rural communities, which are for the most part located inland, have no such facilities and must find some means of disposing of their sewage in the earth.

The discharge of sewage into a brook or running stream is a most dangerous proceeding because of the chance that the water of this stream will be used further down for drinking purposes. Many of the states have laws prohibiting the pollution of streams in this manner, and therefore streams should not be looked upon as available for these purposes. In the Southern states conditions are probably worse than in any other part of the country. The climate encourages a continued outdoor existence throughout the year and many of the inhabitants are ignorant and unsanitary in their habits. This leads to the promiscuous distribution of bowel discharges on the ground in country districts. Such exposure is believed to be the chief cause of the wide-spread infection of hookworm. The hookworm inhabits the bowels and infects the soil wherever discharges are deposited. A large percentage of the inhabitants wear no shoes, and the mud clinging to their bare feet often contains the parasites. The hookworm pierces the skin of the feet and finds its way to the intestines, where the eggs of the next generation are hatched.

Bowel discharges of typhoid patients are of course a most serious threat against the health of those who dwell in the neighborhood. If such a discharge is made on open ground it is exposed to flies, which may carry the infection to the nearest kitchen and transmit it to food or to milk. Many cases are recorded where rain has washed the infection from such discharges into a nearby

well or stream which was used as a water supply, and which produced typhoid fever in the persons drinking the water.

One case may be mentioned which came under the writer's observation, where Italians, camped on the bank of a brook, deposited their bowel discharges on open ground. One of their number having typhoid fever, thereby infected the waters of the brook which was used as a source of supply by five different villages, in which there occurred immediately a typhoid outbreak of over forty cases and seven deaths.

Cesspools and wooden privies are the most common establishments in rural districts for the disposal of the bowel discharges of the inhabitants. The vaults of these are often made of loose stones without any provision for overflow. There is consequently not only a leaching through nearby soil, but an actual overflow on to the surface of the soil. From this exposure, both by means of insects flying to the houses and by the washing of rains into water supplies, infections can be easily carried to the inhabitants of the surrounding country.

The earth closet is the readiest means for the sanitary disposal of the bowel discharges of those who dwell in isolated houses. This consists of the ordinary small wooden building supplied with water-tight cans of metal into which the discharges are received and into which is thrown at the same time a certain quantity of fresh earth shoveled from a box kept in the closet. Lime is also a very good material to mix with such discharges. The iron receptacle should receive a sufficient amount of earth to absorb liquids, so that when it is filled the contents are solid. It should, of course, be frequently emptied and carried to a remote place where the contents can be buried at a suitable depth and covered up with earth. This method of disposal is safe, simple, and cheap, and can be adopted by any isolated farm-house.

Cesspools are only permissible when they are made tight and small and frequently cleaned, and are not allowed to overflow on the surface of the soil or to leak into the surrounding soil in a way which is likely to contaminate water supplies.

The burning of bowel discharges, as it is carried out at times in armies, is an ideal method because it absolutely destroys all chances of infection. The use of disinfectants, such as chloride of lime, is also to be highly recommended.

Where houses are gathered together in groups and in small villages or camps it is economy to provide a common system of sewage disposal, so that all sewage will be delivered through pipes to one plant. Such a plant should be so located that it will not constitute a nuisance to any of the dwellings. Some of the simpler from among the many and expensive plans for the disposal of sewage are adapted for use in small communities. Among these may be mentioned the system called "sub-surface irrigation," in which shallow ditches beneath the soil intermittently receive the sewage and it is digested and absorbed by the biolytical processes of the upper layers of earth. Another method adapted for this purpose is one where a preliminary screening and filtration is followed by the disinfection of the fluid effluent, with such chemicals as chloride of lime. The handling of propositions of this kind is of course beyond the powers of the average citizen, and such installations must necessarily be placed in the hands of specialists.

Water from sinks and laundries in farm houses is usually allowed to run out on to the surface of the ground, where it is likely to collect and to form a wet and unsightly and ill-smelling place. Such water should be led away from the house through pipes, where it can be caught in a cesspool filled with gravel or broken stone. Most of the solids will be retained in this way and the liquid portion carried off by seepage into the surrounding soil. The location of such a drain should of course be one which is remote from the source of water supply.

Garbage Disposal

A pig pen is a valuable institution in one respect, namely, that in many parts of the country it is a ready and sure means for garbage disposal. All waste food and kitchen refuse can be carried to the pigs and will be consumed by them, so that there is no nuisance other than the pig pen itself. Where garbage cannot be gotten rid of in this manner it is necessary to devise a system of garbage disposal which will prevent the indiscriminate throwing of waste food on to the ground in the neighborhood of the house. Accumulations of this sort are bad from a sanitary standpoint not only because they are unsightly and cause offensive odors, but particularly because they attract flies which breed and multiply in such places and may transmit infection to the household.

Wet garbage and food of all kinds should be kept separate from ashes and from trash. A water-tight can is the best sort of receptacle for garbage. Ashes should be placed in another can and trash can be placed in a box. Ashes are not seriously objectionable in character. They can be utilized for walks and roadways and thrown upon the ground without harm. Cans of wet garbage and trash are best disposed of by burning. Rural communities composed of several houses or villages can afford to maintain a crematory of simple form where all of these wastes can be burned up. One of the simplest of these is called a "rock pile" crematory. It consists of stones so grouped together that liquids will filter down between them while solids are retained on the surface. A good supply of air is received through the crevices in the stones and all of the contents can be easily burned up.

In isolated houses, where it is not convenient to maintain a crematory combustible trash can be burned up while wet garbage can be carted off and buried or dumped at a distance remote from the dwelling.

Manure

The manure pile has lately gained recognition as deserving more than ordinary consideration by the sanitarian because it is the headquarters for flies in its immediate neighborhood. Flies breed best in manure. The manure pile has for many years been looked upon as a necessary part of the farm business. The wealth of a farmer used to be judged by the size of the manure pile in his barnyard. The study of agriculture has now shown that the accumulation of manure from horse stables and cow stables in a pile is not the best method for its preservation, but that great waste takes place due to the fermentations and escape of gases from such a deposit. The largest dairies now make a practice of spreading all manure upon the ground daily and none of it is accumulated.

The odors from the manure pile while offensive are not necessarily injurious to health. One of the most recent faults found with these accumulations is due to the discovery that the germs of tuberculosis are very often discharged through the bowels of tuberculous cattle, and consequently the manure pile may be filled with this infection. The breeding of flies in the manure pile is one of the reasons why the household is afflicted with flies in the

summer time. These insects are a menace to health not only because of the material which they may carry from the manure pile, but because they may travel to the surrounding country and feed on matter which contains infection. Much of the typhoid which occurs during the summer and fall months is attributed by some authorities to the prevalence of flies during those seasons of the year.

Recently the writer made an investigation of a typhoid fever outbreak in which at least twenty cases occurring in one summer encampment were probably due to the infection of food with the germs of typhoid fever by flies which had been bred in a nearby manure pile which at times received the discharges of a man who was afflicted with typhoid in a chronic form.

The best remedy for the manure pile is to have none. If it is necessary it should be placed as far as possible from the house. If this cannot be done another easy remedy is to surround it with screens so that flies cannot gain access to it. The application of disinfectants, such as chloride of lime and ordinary unslacked lime, are also measures which will prevent odors and make the heap unattractive for flies.

Mosquitoes

The mosquito is now held chiefly accountable for the spread of malaria, yellow fever, black water fever, dengue, and filariasis. Malaria is the disease of greatest interest to the inhabitants of the United States, because the other diseases are comparatively rare in this country. Mosquitoes lay their eggs in water. The eggs float on the surface of the water and hatch out, forming larvæ which live near the surface. These in a short time grow and develop into adult mosquitoes which fly up from the surface of the water and begin their adult life. Standing water is necessary for these purposes. Running brooks and rivers are not breeding grounds for these insects. In Cuba, Mexico and Central America the common source of water supply is cisterns. Mosquitoes have access to many of these and use them as breeding grounds. The substitution of city water supplies by pipe lines and the abandonment of cisterns have reduced the number of mosquitoes and the diseases contracted from them in a remarkable manner in some of these cities. One of the most remarkable instances is the banish-

ment of yellow fever from the city of Havana, which was accomplished not only by removing the cisterns and standing water but by protecting buildings with proper screens against these insects. In the Panama Canal the fight against the mosquito is the real secret of the success of the American enterprise in that region.

Malaria is transmitted by the mosquito through the biting of some person suffering from that disease whose blood contains the parasites which are sucked with it into the body of the mosquito where the parasites remain. Such a mosquito may later on bite some other person and inject the parasites into his blood, giving rise to malaria in him. The vital statistics show a greater prevalence of malaria in rural communities than in cities. It is obvious that cities are not so favorable to the growth of mosquitoes as are rural districts. In the country there is not only likely to be some standing water, but a greater abundance of the green plants on which the mosquito commonly feeds.

The fight against mosquitoes in rural districts must be carried on first by the drainage of all standing water in the neighborhood of the house. Even old tin cans and pails and the rain barrel and the horse trough are places where mosquitoes will breed. Where they have become a pest and standing water cannot be drained off, the application of kerosene to the water every two weeks will prevent the multiplication of these insects. The kerosene spreads over the surface of the water and kills the eggs and the larvæ.

When insects have once invaded a house so that they cannot be driven out by ordinary means they can be killed by fumigation. Sulphur is the best material to use for this purpose. The burning of a sulphur candle in a properly closed room will kill all the mosquitoes and other insects. The screening of windows and of doors is another important item in the prevention of malaria. Screening is being constantly more widely adopted, and it is a practice which should be insisted upon in rural districts.

This screening should include not only the house but also the place where garbage is kept, and if the garbage-can itself is not covered a screen cover is a good thing to use. The privy must also be thoroughly screened against flies, so that by no possibility can they gain access to the discharges contained there. Where cases of malaria exist the patients should be thoroughly protected against mosquitoes, for in this way it is possible to prevent the disease

from being transmitted from a malarial patient to those who dwell in the neighborhood.

Education

The most important of all sanitary considerations in connection with rural communities is the matter of education. The people themselves must be informed concerning the progress of sanitary science and how to follow a system of clean living if they are to gain the benefits which are to be derived from sanitary knowledge. The best place to begin sanitary education is in the district schools. The old system of teaching physiology and hygiene and the "nature studies" which are now used in the district schools are not sufficient to give the children correct ideas on sanitary matters. There is a movement on foot at the present time to bring about this kind of sanitary instruction in the public schools. It is delayed in the first place because the teachers themselves are comparatively ignorant on sanitary matters. It is therefore necessary to establish a system of sanitary instruction for school teachers, and through them eventually the children in the schools can be reached. Children should be made familiar with the meaning of the word "bacteria" and especially taught the nature of infectious diseases so that they will know them by name. They should also be clearly instructed as to the cause of infectious diseases, and particularly such diseases as are likely to occur in their own part of the country. Simple but important instruction on water supplies, milk supplies, and sewage can be given.

Next to the district schools, the state and county boards of health can play a most important part in education by the regular publication and distribution of bulletins on public health matters. The activity displayed by the Department of Agriculture and the experiment stations established in different states is an illustration of how this kind of work can be done. Persons living in rural communities are all familiar with the bulletins on agriculture. If they could be made equally familiar with bulletins on public health matters it would lead to a great improvement in the sanitation of their dwellings and of their surroundings. Realizing this, some of the states have made a commendable beginning by the publication of occasional bulletins on such matters, but the appropriations of

money for these purposes are so small that the bulletins do not cover the ground and are not regularly distributed.

The Sick are Carriers of Disease

Perhaps one of the most vital reasons for popular education on these subjects lies in the discoveries which have lately been made of the existence of chronic cases of infectious diseases which were formerly thought to be entirely limited to cases in the acute form. It is now known that typhoid fever is not entirely limited to those persons who suffer from acute attacks, but that it may become established in a chronic form and the bacteria remain in the system of some persons for many years. The records show that these bacteria have been carried for more than fifty years in persons who gave no external appearance of having the disease. A recent estimate by one investigator shows that as many as four per cent of the persons having typhoid fever continue to carry the bacteria in their bodies and to discharge them for as long as three years after they have apparently recovered from the disease. One investigator estimates that there are at the present time eighteen thousand persons in apparently good health in the United States who carry the germs of typhoid fever and who must be looked upon as a threat against the health of the communities in which they live. At any time such a person may be the cause of a typhoid outbreak. Tuberculosis has of course for many years been recognized as a chronic disease and the persons afflicted with it as sources of infection. More recently diphtheria has been shown to exist in a chronic condition, and it is beginning to be accepted that in this way the disease is carried on from year to year. There are rumors that scarlet fever is also a disease which exists in a chronic form in some persons, and that it may be passed on in this manner. Possibly in time other infectious diseases will come into the same category. These things being so the matter of personal hygiene on the part of those who are afflicted with these infections in a chronic form is positively necessary to protect their neighbors from contracting the disease from them. On the other hand, the personal care exercised by the individual in his daily conduct toward his neighbors, the food he eats, and the liquids he drinks are the only means at his command for protecting himself against these chronic carriers of disease. It is obvious that public education on these matters at

the present time is the best form of defense. The majority of persons carrying these diseases are undiscovered. The more closely therefore that one adheres to strict personal cleanliness and avoids contact with one's neighbor is one likely to escape accidental transfer of these diseases.

It is to be hoped that public sentiment on matters of sanitation and of general health will in the course of time reach the same degree of interest that is displayed in the study of agriculture. It does not seem unfair to suggest to the public authorities that at least as much money should be spent in instructing the dwellers in rural communities how to raise their own children and to protect themselves against infectious disease, as is now expended in informing them how to raise pigs and how to breed cattle and horses.